YELIZAROV, B.

Radio equipment used in training glider pilots. Kryl. rod. 11 no.12:19-20 D '60. (MIRA 14:3)
(Radio in aeronautics)

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SOV/137-59-5-10912

18.7100

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 5, p 210 (USSR)

AUTHORS: Yelizarov, B.I., Skotnikov, V.V.

TITLE: The Effect of Intermediate Transformation Products on the Proneness to Cold Brittleness of Structural Steels After High Tempering

PERIODICAL: V sb.: Materialy Nauchn.-tekhn. konferentsii po probl. zakalki v goryachikh sredakh i promezhutochn. prevrashcheniyu austenita, Vol 1, Yroslavl', 1957, pp 193 - 205

ABSTRACT: The effect on a_k at +20, -25 and -50°C caused by isothermal quench-hardening within a temperature range of 200° - 400°C and tempering at 500° - 650°C compared to oil-quenching and tempering at the same temperatures, was investigated for several smelts of the following steel grades: 40Kh, 40KhN, 40KhNMA, 45G2 and 35KhGSA. It was established that isothermal quench-hardening of 40Kh, 40KhN and 40KhMNA steel within a range of 200° - 300°C and tempering at 500° - 650°C ensured the same a_k at negative temperatures as conventional quench-hardening and tempering at the same temperatures. Fractures of the specimens were also similar.

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The Effect of Intermediate Transformation Products on the Proneness to Cold Brittleness of Structural Steels After High Tempering

Isothermal quench-hardening at 350° - 400°C, i.e., in the upper range of intermediate transformation entailed reduced a_k and deteriorated appearance of the break. 35KhGSA steel reduces sharply a_k at lower testing temperatures independent on the method of quench-hardening. The drop of a_k at lower temperatures appears less in steel quench-hardened and tempered to R_C 50 than in steel tempered to R_C 28 - 32. A sharper pronounced proneness to cold brittleness in products of isothermal quench-hardening in the upper portion of the intermediate range after high tempering is explained by microstructural heterogeneity, arising as a result of stratification of supercooled austenite into ferrite and austenite enriched with C, which preserved a definite orientation. In the lower portion of the intermediate range the dimension of austenite particles and the degree of its enrichment with C is lesser, reducing the microstructural heterogeneity and approaching the structure and properties of steel to the state of tempered martensite.

M.Sh.

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S/123/59/000/006/012/025
A005/A001

Translation from: Referativnyy zhurnal, Mashinostroyeniye, 1959, No. 6, p. 117, # 20941

AUTHOR: Yelizarov, B. I.

TITLE: Scientific and Technical Conference on Hardening Steels in Hot Media and Intermediate Transformation of Austenite 16

PERIODICAL: Yaroslavsk. Prom-st' (Sovnarkhoz Yaroslavsk. ekon. adm. r-na), 1958, No. 1, p. 59

TEXT: In December 1957, a scientific and technical conference was held at Yaroslavl' on the problem: "Hardening steels in hot media and intermediate transformation of austenite". Theoretical questions were considered of the intermediate transformation of austenite, the structure, and the phase compostion of the products of austenite transformation; the influence of the intermediate austenite transformation products on the properties of steel; the methods of plotting the thermokinetic diagrams of austenite transformation and their utilization for determining the thermal treatment conditions; the isothermal hardening and other methods of hardening in hot media. The Conference noted the practiced value of

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using thermokinetic diagrams for determining the thermal treatment conditions of different products. The successful application of isothermal hardening is shown in the lectures for enhancing the structural strength of the parts in mechanical engineering, for enhancing the endurance and strength of tools of high-speed and other tool steels; the technological advantages of hardening in hot media are pointed out.

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Translator's note: This is the full translation of the original Russian abstract.

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YELIZAROV, B.I.

AUTHORS: Yelizarov, B. I., Pomerants, D. M. and Skotnikov, V.V.

TITLE: Scientific-Technical Conference on Hardening in Hot Media and Intermediate Transformation of Austenite (Yaroslavl') (Nauchno-tekhnicheskaya konferentsiya po zakalke v goryachikh sredakh i promezhutochnomu prevrashcheniyu austenita (Yaroslavl'))

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 5, pp 58-63 (USSR)

ABSTRACT: A scientific-technical conference on hardening steels in hot media and intermediate austenite transformation was held in Yaroslavl', December 16-19, 1957, which was convened by the Yaroslavl' Regional Directorate of the NTO Mashprom jointly with the metals technology and heat treatment section of the Central Directorate of NTO Mashprom. 180 people participated who came from factories, research institutes and teaching establishments of Moscow, Leningrad, Novosibirsk and numerous other towns. The authors of this report state that it can be assumed that the following are established facts relating to intermediate transformation:

1) Decomposition of the austenite in the intermediate range begins after a certain incubation period;

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2) Intermediate transformation stops when a certain quantity of non-decomposed austenite still remains, whereby the completeness of the transformation increases with decreasing temperature;
3) Diffusion redistribution of carbon takes place during intermediate annealing;
4) Decomposition of austenite in the intermediate range as well as the penetration after completion of the transformation leads to a decrease of the martensitic point of the non-transformed austenite;
5) On changing over from the pearlitic to the intermediate range, a break occurs in the continuity of the change of the degree of dispersion, hardness and other properties of the decomposition products;
6) In the decomposition products of the lower part of the intermediate region existence of the tetragonal α-phase is detected;
7) The products of decomposition of the upper part of the intermediate range are most frequently "feather" shaped, whilst the decomposition products of the lower part are acicular;

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8) Intermediate transformation is accompanied by the formation of a relief on the polished surface of a cut;
9) In steels which are alloyed with carbide forming elements, the intermediate transformation is characterised by a separate branch of the C-shaped curve which is separated from the pearlitic range by a zone of relatively stable austenite;
10) Irrespective of the chemical composition of the steel the carbide in the intermediate transformations is a cementite type carbide and, as regards the contents of alloying elements, it does not differ from the average composition of the steel;
11) The static strength and the physical properties of the decomposition products of the lower part of the intermediate range does not differ materially from similar properties of the martensite products tempered to achieve the same hardness;
12) The decomposition products of the austenite in the intermediate range after high temperature tempering have less favourable mechanical properties than the structure obtained after hardening for obtaining martensite followed

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by high temperature tempering;
13) A full and even a partial decomposition of the austenite in the upper region of the intermediate range causes appearance of a particular variant of irreversible temper brittleness which is characterised by a trans-crystalline fracture.
Doctor of Technical Sciences R. I. Entin and L. I. Kogan in their paper "On the Theory of Intermediate Transformation of Austenite" communicated experimental data on the elementary reactions, structure and composition of transformation products of austenite in the medium range. They pointed out that transformation in this range is not due to redistribution of the alloying elements in the austenite but to diffusional redistribution of carbon in the austenite. Depending on the composition of the steel and the transformation temperature, an increase or a decrease of the carbon concentration in the residual austenite may take place, which is due to separating out of carbides. In some cases (for instance in nickel steels) the process of carbon enrichment of the residual austenite at a later stage of the transformation is followed by a

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separation of the carbon phase from the austenite and its impoverishment in carbon. Available data on the tetragonal structure of the α-phase which forms in the intermediate range, on the martensite character of the polymorphous γ → α transformation in carbon-free alloyed iron in this range and on the formation of a micro-relief indicate that the α-phase during this transformation is formed according to the martensite type. Taking into consideration the obtained data, the authors consider that transformation of the austenite in the intermediate range is due to a redistribution of the carbon in the austenite and a formation of sections with increased and with reduced carbon concentrations. Sections of the austenite with reduced carbon concentration transform into martensite and those with increased carbon concentrations may possess a differing stability depending on the alloying and on the transformation temperature; under certain conditions carbides will start to separate out from the austenite. Transformations similar in character to the intermediate transformation of the austenite are specific features of

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the alloys containing elements with sharply differing speeds of diffusion (iron and carbon in steel). Candidate of Technical Sciences L. M. Pevzner, G. D. Kubyshkina, N. M. Popova, L. S. Zaslavskaya, G. M. Rovenskiy in their paper "On Intermediate Transformation" investigated in detail the phase composition of the products of intermediate transformation. Particularly valuable are the X-ray structural and the chemical analyses of the residual austenite which is precipitated electrolytically. The authors compared products of intermediate transformation in Cr and Si steels. They stated that in chromium steel clear lines of the carbide Fe_3C were observed by X-ray analysis from 280°C onwards, whilst in silicon steels this carbide is detected only from the 400°C isotherm onwards. They also investigated the problem of redistribution of alloying elements (Cr and Si) during intermediate transformation. It was established that in the non-decomposed austenite, the silicon content is approximately equal to its average content in the initial austenite. In chromium steels at 280-350°C, the chromium

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concentration in the carbide does not exceed the average concentration of chromium in the steel. At a higher temperature (400-420°C) an enrichment of the carbide with up to 7 to 8% Cr was observed for a steel containing 3-5% Cr. The authors express the following views on the mechanism of intermediate transformation:

1) Intermediate transformation takes place at lower temperatures than recrystallisation, i.e. at a temperature with a sharply impeded self-diffusion of the iron and diffusion of the alloying elements;

2) the fundamental difference of the intermediate transformation from the pearlitic one is the change in the mechanism of the $\gamma \rightarrow \alpha$ transformation, namely, a change from the ordinary diffusion kinetics to the martensitic one, which is confirmed by the presence of a relief on the surface of a cut and the existence of a relation between the crystallographic directions of the forming α-phase and the original austenite;

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3) the process of decomposition begins with a preliminary redistribution of the carbon in the austenite; it is assumed

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that two elementary processes take place, namely $\gamma \rightarrow \alpha$ transformation according to the martensitic kinetics in the impoverished section and carbide separation from the enriched section.

The authors found that in silicon steel an enrichment with carbon of the residual austenite takes place after ordinary hardening and tempering. The degree of enrichment of the austenite reaches the same values as in the case of iso-thermal intermediate transformation. Taking this fact into consideration, it is assumed that during low temperature tempering decomposition of the residual austenite takes place according to the laws governing the transformation of super-cooled austenite in the intermediate range. Therefore, the authors arrived at the conclusion that the favourable mechanical properties of silicon steels after isothermal hardening are due to a particular structural state: a disperse α-phase with a small quantity of carbide which is coherently linked to it and a considerable quantity of residual austenite.

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V. V. Skotnikov in his paper "On the Mechanism of Formation, Phase State and Structural Shapes of Products

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of Intermediate Transformation of the Austenite" investigated the structural shapes and the properties of the products of intermediate transformation in engineering alloy steels on the basis of micro-structural analysis and hardness measurement. He found that the initial products of intermediate transformation in low and medium carbon steels have a clearly pronounced lamellar structure which is similar to that of the eutectoidal structure, whereby the spacing between the lamellae decreases regularly with decreasing transformation temperatures. It was established that the phase which is redistributed in the products of intermediate transformation (which is usually assumed as being a carbide phase) has the following features: the quantity of this phase exceeds by far the quantity of the carbide phase which can form for a given carbon content and this is particularly pronounced in the case of low carbon steels; the speed of spheroidisation of this phase is incommensurably larger than that of the carbide phase in pearlite; with increasing duration of isothermal annealing, the dimensions of the particles of

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this phase will decrease appreciably, they "dry up". On the basis of his own and other results, the author concludes that the mechanism of intermediate transformation consists in a diffusion layering of the super-cooled austenite and has the character of a eutectoidal decomposition. Since one of the phases differs from the initial austenite only by the sharp difference in the carbon concentration, the intermediate transformation can be referred to as monotectoidal in analogy with monotectic transformations. Sub-division of the intermediate range into two regions is due to differences in the nature of the formed α-phase: in the upper region ferrite forms with carbon concentrations approaching the equilibrium one, whilst in the lower region the ferrite is saturated with carbon (low carbon martensite). The author disputes the phenomenon of self-braking of the process of intermediate transformation since one of the phases of the forming product consists of carbon enriched austenite. The formation of a carbide phase is due to secondary processes which take place after the basic process of layering of the initial austenite.

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P. V. Romanov read the paper "Nature of Intermediate Structures in the Light of Relations Governing the Thermo-Kinetic Transformation of the Austenite". On the basis of a large number of thermo-kinetic diagrams plotted by the author, relations were established governing the transformation of austenite during continuous cooling of binary alloys for iron with carbon, nickel, molybdenum and chromium and also for steels with 1, 2 or a larger number of alloying elements. The author expressed the view that the nature of intermediate transformation of austenite in alloy steels differs from that of isothermal transformation (in the intermediate temperature range) of carbon steel. He proposes to consider the first as a polymorphous transformation of the alloys iron-alloying element with a regular reconstruction of the lattice $\gamma \rightarrow \alpha$. The second is considered as decomposition of the austenite which is determined by the diffusion of the carbon during isothermal annealing. He proposed a differing terminology for designating the decomposition products of the austenite

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of alloy steel and of the products of isothermal transformation of carbon steels.

L. P. Ivanova in her paper "Features of Intermediate Transformation of Austenite in Silicon Steels" investigated the intermediate transformations in the steels 60S2 and 37KhS on the basis of the magnetometric and X-ray structural analysis, measurement of the electric resistance, determination of the mechanical properties and application of chemical and X-ray structural analysis of electrolytically produced sediments. On the basis of the experimental data, the author concludes that, during intermediate transformation, self-diffusion of iron occurs in silicon steels with a slow diffusion of carbon which is impeded owing to the presence of silicon.

V. T. Biryulin and Doctor of Technical Sciences V. D. Sadovskiy in their paper "On the Influence of Isothermal Hardening on the Mechanical Properties of Steel" investigated the impact strength and the hardness of the steels 40KhNMA, 35KhGSA and 38KhMYuA as a function of the hardening and tempering regimes. The magnetometric method was used for measuring the quantity of residual

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austenite and for plotting the thermal kinetic diagrams of the super-cooled austenite. The authors point out that long duration (100 hours and more) annealing in a hot medium leads to a decrease of the impact strength whereby in hot media with temperatures of 200 to 300°C, the impact strength increases at first, reaching a certain value with increasing annealing duration and, then, the impact strength begins to decrease. If the medium has a temperature of 350 - 400°C, a continuous drop is observed in the impact strength with increasing duration. Comparing this phenomenon with the irreversible temper brittleness, the authors point out that embrittlement of the steel after ordinary hardening and tempering develops rapidly (within a few minutes) for the temperature range 300 to 400°C and on isothermal hardening it develops after many hours. After hardening (300°C) the drop in impact strength is accompanied by an inter-crystalline fracture; for the isotherms 350 and 400°C the fracture is intra-crystalline. Occurrence of an intra-crystalline fracture is attributed by the authors to the features of the micro-

structure of the transformation products in the upper part of the intermediate range. It was established that in steel hardened from 400°C the inter-crystalline fracture, which is characteristic for reversible temper brittleness, is obtained only after high temperature tempering (675°C) followed by rapid cooling and subsequent embrittlement at 550°C.

V. F. Senkevich and Professor I. N. Bogachev in their paper "Isothermal and Step-wise Hardening of Steel" analyse the mechanical properties of the engineering steels 45Kh, 45G2 and 37KhS after treatment in molten alkalies. On the basis of their results the authors arrive at the conclusion that isothermal hardening in molten alkalies is technologically favourable for a number of steels and ensures favourable mechanical properties. However, this is possible only within a narrow range of super-cooling temperatures and deviation from this range can be accompanied by a sharp deterioration in the properties, particularly of the impact strength. For Steel 45G2 and also 40Kh, the hot hardening is a more

reliable method of heat treatment in molten alkalies and this is particularly suitable for components of small and medium sizes.

Candidate of Technical Sciences N. I. Popova in her paper "Influence of the Products of Intermediate Transformation on the Physical and Mechanical Properties of Engineering Steels" investigated the influence of various quantities of intermediate transformation products (at 300 to 450°C) on the mechanical properties and on the appearance of the fractures of specimens of the Steels 35KhNZM and 35KhN1M. The steel structure was investigated by optical and electron microscopes and also by chemical analysis of the carbide sediment of steels with differing initial structures. Studying the character of the changes in the mechanical properties of the steel, hardened according to various regimes, as a function of the tempering temperature, the author established that the influence of intermediate transformation products on the mechanical properties of the steel depends on the temperature at which these transformations take place. The quantity of

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the decomposition products of the austenite forming at 300°C has practically no influence on the yield point, the impact strength and the character of the fracture of the steel compared with the corresponding characteristics obtained after ordinary hardening and tempering at the same temperature. The decomposition products of the austenite forming at higher temperatures (350 and 400°C) bring about a reduction of the yield point and the impact strength and also a less favourable appearance of the fracture whereby the quantity of the products for which a deterioration of the mechanical properties is observed will be the smaller the higher the decomposition temperature. It was detected by means of the electron microscope that, after hardening, the steel (with products of intermediate transformation) has a non-uniform structure with a non-uniform distribution of the carbides which increase with increasing isothermal temperature. After tempering at 600°C the non-uniformity is conserved and the quantity of carbides remains the same as that after hardening. The structure obtained after tempering of the martensite is uniform and contains a uniform distribution

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of disperse carbides. Analysis of the carbide sediments showed that after ordinary hardening and tempering at 600°C the carbides contain Cr, Mo and Mn in quantities which are near to their respective contents in the carbides of residues of annealed steel. The compositions of the carbides will be the same in the products of transformation of austenite forming at 300°C and equally tempered at 600°C. The carbide deposits of the products of intermediate transformation formed at 350, 400 and 450°C (after tempering at 600°C) proved to have a lower content of Cr, Mn and Mo. On the basis of the obtained results, the author concludes that the physical and mechanical properties after tempering of steel hardened to obtain martensite differ from that of steel which contains in its structure products of intermediate transformation. Apparently, this is due to the differing shape, magnitude and character of the distribution of carbides and also to the distribution of Cr and Mo between the carbide and the metallic phases of these structures.

B. I. Elizarov and V. V. Skotnikov in their paper "Influence of the Products of Intermediate Transformation on the Tendency to Cold Shortness of Engineering Steels

After High Temperature Tempering" investigated the impact strength of the steels 40Kh, 40KhN, 40KhNMA, 45G2 and 35KhGSA at +20, -25 and -50°C. It was established that as regards cold shortness after high temperature tempering of steel following ordinary and isothermal hardening, the investigated steels can be classified in the following sequence: 40KhMA, 40KhN, 40Kh, 45G2, 35KhGSA. The products of isothermal decomposition of austenite in the upper part of the intermediate range, after high temperature tempering, show a more pronounced tendency to cold shortness than the tempering products of martensite and the products of isothermal decomposition of austenite in the lower part of the intermediate range. The authors explain this phenomenon on the basis of the mechanism of intermediate transformation proposed by V. V. Skotnikov.

D. M. Pomerants and V. V. Skotnikov in their paper "Features of Irreversible Temper Brittleness in the Products of Intermediate Transformation of Engineering Automobile Steels" investigated the dependence of the impact strength and the change in the quantity of the

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residual austenite of the steels 40Kh, 40KhN, 40KhNMA, 35KhGSA, OKhM, 40KhGT and 45G2 on the temperature of the medium during isothermal hardening and the tempering temperature. They arrived at the following conclusions:
1) No definite relation was established between the irreversible temper brittleness and the change in the quantity of the residual austenite;
2) temper brittleness of the first type will be the less pronounced in isothermally hardened steel the higher the temperature of the isotherm and for the isotherms 350 and 400°C this type of brittleness does not occur;
3) the transformation products in the top part of the intermediate range tend to develop a particular type of irreversible brittleness (second type) which is characterised by intra-crystalline fracture. The authors attribute this type of fracture to the features of the structure of the products of intermediate transformation, which are considered as being a eutectoidal mixture of the α-phase and of the enriched austenite. The first type of brittleness (with an inter-crystallite fracture) is

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associated with the process of carbide formation in the matrix α-phase which is over-saturated with carbon in the products of transformation of the lower part of the intermediate region. Brittleness of the second type develops as a result of the processes of tempering of the γ-phase which distributes in the ferrite within the limits of what was originally the austenite grain. In a number of cases, even before tempering, the presence of carbon enriched austenite-martensite can cause brittle fracture along the grain. This elucidates the observed intra-crystalline fracture of transformation products of the upper part of the intermediate region which manifests itself strongly after tempering.

Candidate of Technical Sciences N. V. Kazakova and N. V. Koroleva in their paper "On the Influence of the Decomposition Products of the Austenite in the Intermediate Range on the Tendency of the Steel to Develop Temper Brittleness" investigated the influence of the products of intermediate transformation on the tendency of the steel to develop reversible temper brittleness and to

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elucidate the nature of this phenomena in the steels 35KhN3, 35KhN3M, 35KhN3V and 35KhM after isothermal hardening at 250-450°C and tempering at 600-630°C with various cooling speeds. The impact strength was tested at temperatures between +200 and -180°C, studying also the character of the fracture and the micro-structure of the steel by means of optical and electron microscopes. Evaluation of the tendency to develop temper brittleness was carried out on the basis of the temperature of transition of the steel into the brittle state. The authors arrived at the following conclusions:

1) A partial transformation of austenite in the intermediate range during hardening has practically no influence on the character of separating out of the embritteling intergranular phase during slow cooling of the steel after tempering;

2) the intergranular phase which separates out during slow cooling of the steel after tempering shows less influence on the embrittlement than the orientated acicular carbides which form during the intermediate decomposition

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of the austenite. Therefore, if products of intermediate decomposition are present in the structure, the fracture of the steel in the case of impact tests will proceed along the grain even if the steel was cooled slowly after tempering and an embrittled phase separated out at the grain boundaries;

3) with increasing temperature of the partial intermediate transformation of austenite (during hardening) and increasing quantities of the products of this transformation, the critical temperatures of brittleness increase both in the case of rapid as well as in the case of slow cooling after tempering. In the first case the increase is more intensive than in the second and, as a result of that, the critical brittleness temperatures are close to each other.

Candidate of Technical Sciences B. N. Arzamasov in his paper "On the Hardenability and Through Hardenability of Engineering Steels During Isothermal Heat Treatment" studied these factors for the steel 30KhGSA by investigating the hardness of the micro-structure and also by

comparing the cooling curves of the core and of the surface of specimens of various diameters with a thermo-kinetic diagram. Furthermore, the cooling ability was investigated of various hot media based on nitrites and nitrates of sodium and kalium and also of soda lye and of potash lye. The author established that the cooling capacity of the investigated hot media depends on their temperature and does not depend on their composition; with decreasing temperature of the medium, its cooling capacity increases appreciably.

R. P. Radchenko in his paper "On the Selection of the Regime of Heat Treatment of Large Components by Means of Thermo-kinetic Diagrams" gave data on the investigation of the steel 35KhNM of various heats for which thermo-kinetic diagrams were plott d on the basis of dilatometric data for various austenisation temperatures from the inter-critical interval up to $Ac_3 + 100^{\circ}C$. He has shown that small quantities of aluminium as an alloying element do have an influence on the hardenability of steel. A comparative study was made of the mechanical properties

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along a cross section of a blank of 130 mm dia. (after cooling in oil, in water and through water in oil) with the properties of specimens cooled with various speeds. The following conclusions were arrived at:
1) The products of transformation of the right part of the intermediate range on the thermo-kinetic diagram after high temperature tempering possesses a low impact strength and a low limit of proportionality and the fracture of the specimens has a crystalline structure;
2) if the thermo-kinetic diagram of austenite transformation is available, it is possible to establish the optimum regime of heat treatment (of hardening) of components without testing specimens treated according to various variants, provided that the properties of the structural components and the cooling curve of the core of the component are known;
3) the cooling curves of the component found experimentally for any grade of steel are applicable also for other similar grades of steel.

Candidate of Technical Sciences B. N. Arzamasov in his paper "Dependence of the Fatigue Limit, the Strength and

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the Plasticity of the Steel 30KhGSA on the Regimes of Isothermal Hardening" investigated the mechanical properties for the purpose of establishing a relation between the fatigue limit and other mechanical characteristics on flat specimens of sheet made of the steel 30KhGSA of a thickness of 2 mm. The specimens were hardened in a hot medium of 250, 300, 350 and 400°C. The duration of heating at these temperatures was such as to obtain the fullest decomposition of the austenite (15 mins, 40 mins, 5 hours and 10 hours respectively). The author concluded that on increasing the temperature of the isothermal hardening from 250 to 450°C under conditions of an as complete as possible decomposition of the austenite, the fatigue limit of 30KhGSA steel increases, in spite of the decrease of the strength and the yield point and also of the breaking strength and the hardness.

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Professor I. N. Bogachev and R. I. Mints in their paper "Combination of Heat Treatment with Oxidation in Melts of Oxidising Agents" investigated the possibility of

combining hardening or tempering in molten alkalies with oxidation (addition of nitrite and nitrate sodium salts). It was established that the process of oxidation in these media takes place in jumps whereby a transition is observed from the lower oxide types into higher types of oxides and, in addition to oxidation, partial dissolution of the metal takes place. An optimum composition of the medium has been worked out and the treatment time was determined which would ensure obtaining an oxide film which possesses the highest protective capacity. In this case, treatment at 400 to 500°C increases the resistance to corrosion six to sevenfold compared to untreated components and three to fourfold in the case of a treatment temperature of 300°C. Oxidation also increases the wear resistance of cutting tools. The currently applied treatment of tools in a vapour atmosphere can be substituted by treatment in molten oxiding agents.

I. G. Rivkin in his paper "Influence of Isothermal Treatment on the Strength of Cast and Rolled High Speed

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Steel" drew attention to the fact that a considerable proportion of cutting tools are scrapped due to cracks and not due to natural wear. Therefore, the mechanical properties have been studied of the high speed steel R9 (static compression tests, bending and torsion tests, determination of the impact strength and of the fatigue limit) after various hardening regimes: current type hardening; step-wise hardening in a medium at a temperature of 560°C (15 minutes); isothermal hardening (Variant I) in a medium of a temperature of 250 to 260°C (four hours); isothermal hardening in a medium at 560°C (Variant II, three hours) and transfer into a medium at 250-260°C (three hours); combined isothermal hardening and cooling in a medium of 250-260°C (four hours) followed by transfer to a medium of 560°C (three hours) and cooling again in a medium of 250-260°C (three hours). For all these variants the above treatment was followed by treble tempering for one hour at 560°C. The author concluded that isothermal hardening improves appreciably the mechanical properties of cast and rolled high speed

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tool steels and the most effective proved to be the combined treatment and the treatment according to Variant I. It was established that isothermal hardening increases the service life of the cutting tool.

Main Results of the Conference. There was a discussion relating to the theory of intermediate transformation, the structure and the composition of the products of intermediate transformation as a result of which certain important problems were singled out for further investigation in this field:

a) Investigation of the structure and mechanism of the formation of the α-phase;
b) Investigation of the structure of the steel by electron microscopic and phase analysis;
c) Investigation of the fine structure of the γ-phase (distortion of the crystal lattice, of the size of blocks, etc.) in conjunction with incomplete transformation;
d) Study of the transformation of residual austenite during tempering in the intermediate range;
e) Study of brittleness phenomena.

129-58-5-16/17

Scientific-Technical Conference on Hardening in Hot Media and Intermediate Transformation of Austenite (Yaroslavl')

The delegates of the conference pointed out the practical value of thermo-kinetic diagrams for working out heat treatment regimes of various components and the necessity of more thorough investigations in various organisations. It was pointed out that isothermal hardening is successfully applied for increasing the structural strength of important components in engineering and also the strength and service life of tools made of high speed and other tool steels. It was also pointed out that hardening in hot media has certain technological advantages, e.g. reduction of the distortion and of the residual stresses, shortening of the heat treatment cycle, possibility of obtaining a bright and an oxidised surface. The necessity was stressed of wider utilisation of progressive methods of heat treatment.
(Note: This is a complete translation and not an abstract).

AVAILABLE: Library of Congress.

Card 29/29 1. Conferences-Metallurgical-Yaroslavl' 2. Steel-Hardening-USSR 3. Austenitic steels-Transformations

SOV/123-59-16-63631

Translation from: Referativnyy zhurnal. Mashinostroyeniye, 1959, Nr 16, p 7 (USSR)

AUTHOR: Yelizarov, B.I.

TITLE: Checking the Quality of Production and Maintenance of Accuracy of Gages at the Yaroslavl' Motor Works

PERIODICAL: Yaroslavsk. prom-st' (Sovnarkhoz Yaroslavsk. ekon. adm. r-na), 1958, Nr 8, pp 37-39

ABSTRACT: The organization and methods of the technical control of materials, semi-manufacture and finished products as well as the manufacturing processes in the assembly shop, the foundry, the forge and in the thermic shops are described. The work of the central gaging laboratory, of the control and checking points of the various shops and the checking rooms for precision measurements to secure the accuracy of control instruments and the uniformity of gages at the Plant, was reviewed.

P.Ye.A.

Card 1/1

YELIZAROV, B.V.; KRYLOV, G.N.; MAKAROV, G.I.

Asymptotic methods for the calculation of transients in low-frequency filters. Radiotekhnika 14 no.2:63-69 F '59. (MIRA 12:1)
(Radio filters)

27589
S/108/61/016/010/002/006
D209/D306

9.2590

AUTHORS: Yelizarov, B.V., and Makarov, G.I.

TITLE: Transients in delay lines with a great many sections

PERIODICAL: Radiotekhnika, v. 16, no. 10, 1961, 10 - 19

TEXT: This article was read in May 1960 at the Radio-Day All-Union meeting of the Scientific and Technical Society of Radio Engineering and Electrical Communication im. A.S. Popov. The present article is a continuation of the work of the authors (Ref.1: B.V. Yelizarov, G.N. Krylov, G.I. Makarov, Radiotekhnika, vol. 14, no. 2, 1959; Ref. 2: V.B. Yelizarov, G.N. Krylov, G.I. Makarov, Radiotekhnika, vol. 14, no. 10, 1959) on the use of asymptotic methods for determining the transients in delay lines. The circuit considered in this article consists of n symmetrical identical M-type sections Fig. 2 of a low-pass filter connected in series, loaded by Z_L and excited from a voltage generator with internal resistance Z_g. The properties of such a circuit are studied by deriving its

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transfer coefficients K(X)

$$K(x) = \frac{Z_L}{(Z_L + Z_g)\left[\operatorname{ch} ng + \frac{Z_c^2 + Z_L Z_g}{Z_c (Z_L + Z_g)} \operatorname{sh} ng\right]} = \frac{2 Z_L Z_c e^{-ng}}{(Z_c + Z_L)(Z_c + Z_g)(1 - q)};$$

$$q = \frac{(Z_c - Z_L)(Z_c - Z_g)}{(Z_c + Z_L)(Z_c + Z_g)} e^{-2ng}. \qquad (2)$$

where Z_c, Z_L, Z_g, g - are functions of dimensionless complex frequency $x = p/\omega_o$ and ω_o - the cut-off filter frequency, g - being the propagation constant. The stationary characteristic is found considering T - sections only and $Z_g = R_g$ and $Z_L = R_L$, so that

$$r_g = \frac{R_g}{Z_c(0)}; \quad r_L = \frac{R_L}{Z_c(0)}. \qquad (4)$$

can be introduced. K(x) can then be represented as

$$K(x) = \frac{K_0}{f_2(x)};\; f_2(x) = \operatorname{ch} ng + \frac{r_1 r_2 + 1 + x^2}{(r_1 + r_2)\sqrt{1 + x^2}} \operatorname{sh} ng. \tag{18}$$

and the output voltage by

$$U_{out}(\tau) = \frac{1}{2\pi i} \int_{\sigma - i\infty}^{\sigma + i\infty} K(x) U_{in}(x) e^{\tau x} dx,\; \tau = \omega_0 t, \tag{19}$$

where $V_{in}(x)$ - the generalized spectrum of input voltage. The determination of the root sign in K(x) is arbitrary since after the transformation of ny perbolic functions fz(x) is represented by a polynomial of the order 2n + 1. It can also be shown that f2(x) has simple roots - and

$$\text{if } t_1 = \frac{mx}{\sqrt{1 + (1 - m^2)\, x^2}}, \quad \text{hence } x = \pm \frac{t_1}{\sqrt{m^2 - (1 - m^2)\, t_1^2}} \tag{20}$$

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where $m = \sqrt{1 - \varkappa / 1 + \varkappa}$. Also

$$t_1 = \mathrm{sh}\, g/2 \tag{21}$$

so that

$$\mathrm{th}\, ng = -\frac{\sqrt{1+x^2}\,(r_L + r_g)}{r_L r_g + 1 + x^2},$$

or

$$g = \frac{-1}{n}\,\mathrm{Arth}\,\frac{\sqrt{1+x^2}\,(r_L + r_g)}{r_L r_g + 1 + x^2} = \frac{1}{2n}\,Ln\,\frac{(\sqrt{1+x^2} - r_g)(\sqrt{1+x^2} - r_L)}{(\sqrt{1+x^2} + r_g)(\sqrt{1+x^2} + r_L)}. \tag{22}$$

and finally from (22), (21) and (20)

$$x = \frac{\mathrm{sh}\left[\frac{1}{4n}\left(2\pi i s - \ln\frac{(\sqrt{1+x^2} + r_L)(\sqrt{1+x^2} + r_g)}{(\sqrt{1+x^2} - r_L)(\sqrt{1+x^2} - r_g)}\right)\right]}{\sqrt{m^2 - (1 - m^2)\,\mathrm{sh}^2\left[\frac{1}{4n}\left(2\pi i s - \ln\frac{(\sqrt{1+x^2} + r_L)(\sqrt{1+x^2} + r_g)}{(\sqrt{1+x^2} - r_L)(\sqrt{1+x^2} - r_g)}\right)\right]}} \tag{23}$$

$$s = 0, 1 \ldots n.$$

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is obtained. Taking the real and imaginary parts of Eq. (23), expressions of the type of

$$\alpha = f_3(\alpha, \beta); \; \beta = f_4(\alpha, \beta) \tag{24}$$

are obtained, from which α and β can be consecutively obtained. Functions f_3 and f_4 are very complicated. Their iterative expressions converge very quickly, however, , and are non critical with respect to the initial approximation, e.g. the evaluation of roots for $n = 50$ using the fast computer СТРЕЛА (STRELA) takes only 3 minutes. Knowing the poles of $K(X)$ and of $U_{in}(X)$, $U_{out}(\tau)$ can be represented as

$$U_{\text{out}}(\tau) = U_{\text{st}}(\tau) + K_0 \left[\frac{U_{in}(x_0) e^{\tau x_0}}{f_2'(x_0)} + 2\mathrm{Re} \sum_{s=1}^{s=n} \frac{U_{in}(x_s) e^{\tau x_s}}{f_2'(x_s)} \right], \tag{25}$$

or

$$U_{\text{out}}(\tau) = U_{\text{st}}(\tau) + \sum_{s=0}^{s=n} M_s e^{-\alpha_s \tau} \cos(\beta_s \tau + \varphi_s). \tag{26}$$

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$U_{st}(\tau)$ is the steady state solution for poles of $U_{in}(x)$ and all other terms tend to zero for $\tau \longrightarrow \infty$ and determine the transients. For convenience the constant factor U_0 can be extracted and then $U_{out}(\tau) = U_o \cdot U_1(\tau)$ with

$$\lim_{\tau \longrightarrow \infty} U_1(\tau) = 1 \tag{27}$$

and only the graph of $U_1(\tau)$ can be plotted. All calculations were made by the authors after programming the "Strela" computer and much numerical material has been compiled which because of the limited space could not be reproduced in the article. Only $U_1(\tau)$ for $n = 5$ is given in all figures and graphs. For larger n the reasoning remains the same but the transients become much lengthier. The graph of $U_1(\tau)$ is given for various $\varkappa$, if $r_g = r_L = 1$ with unit impulse function at the input. The values of α_s, β_s, M_s and φ_s for

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Transients in delay lines ...

$\varkappa = 0$ are given in tabulated form. As may be seen the change in mutual inductance strongly influences the delay and the shape of the signal. If at the same time $\varkappa > 0$, the delay only varies, for $\varkappa < 0$ both the delay and the signal shape are changed. From the point of view of overshoots there exists a certain optimum value of $\varkappa$. This value is $\varkappa_{opt} \approx -0.25$. Fig. 6 shows $U_1(\tau)$ with input signal

$$U_{in}(\tau) = \begin{cases} 0 & \tau < 0, \\ \sin \Omega_c \tau & \tau > 0 \end{cases}, \quad \Omega_c = \frac{\omega_c}{\omega_0}, \tag{28}$$

for $r_g = r_L = 1$; $\Omega_c = \omega_c/\omega_0 = 0.5$ ($\omega_0 = \frac{2}{\sqrt{LC}}$) for various $\varkappa$ and $\Omega_c = 0.2$. Curve 1 - $\Omega_c = 0.2$, $\varkappa = 0$; curve 2 - $\Omega_c = 0.5$, $\varkappa = 0.3$; curve 3 - $\Omega_c = 0.5$, $\varkappa = 0$; curve 4 - $\Omega_c = 0.5$; $\varkappa = -0.3$. With a further increase in frequency the length of transients rapidly increases and the effect of parameters begins to be felt. The characteristic shape of output signal for frequencies near the cut-off is shown. The envelope of the signal, while oscillating slowly tends to its

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steady state value and time taken depends on all parameters but mainly for $\Omega_c \to 1$. The derived exact expression (26) allow not only certain physical phenomena to be demonstrated but are also useful as a means of checking the accuracy of approximate expressions derived earlier by the authors (Refs: 1, 2: Op.cit.). The main term of

$$U_{\text{o.x}}(\tau) = \frac{1}{2}\left[2n\int_0^\tau \frac{J_{2n}(t)}{t}\,dt - I_1\right]. \qquad (29)$$

describes the process more accurately than the expression obtained earlier (Refs 1, 2: Op.cit.) and is handier in calculations. The case of a unit impulse input is then considered. There are 8 figures, 3 tables and 4 Soviet-bloc references [Abstractor's note: Ref. 4, although in Russian, is a translation from an English-language publication].

SUBMITTED: February 11, 1960 (initially)
December 19, 1960 (after revision)

Card 8/9

YELIZAROV, B.V.

Method for calculating transients in low-pass ladder-type filters making allowance for losses. Vest. LGU 18 no.10:131-133 '63.
(MIRA 16:8)

(Electric filters)

YELIZAROV, D.A.; MIROSHNICHENKO, V.A.

Ileocoloplasty following the resection of the left half of the large intestine. Khirurgiia 39 no.6:97-102 Je '63.
(MIRA 17:5)

1.Iz 1-go khirurgicheskogo otdeleniya (zav. - kand. med. nauk P.N. Sholom) Krasnodarskoy gorodskoy bol'nitsy No.3 (glavnyy vrach K.A. Kushin).

S/123/59/000/010/055/068
A004/A001

Translation from: Referativnyy zhurnal, Mashinostroyeniye, 1959, No. 10, p. 188,
38663

AUTHOR: Yelizarov, D. F.

TITLE: The Use of Oxygen in Foundry Production 18

PERIODICAL: Tekhn.-ekon. byul. Sovnarkhoz Zaporozhsk. ekon. adm. r-na, 1958, No. 3, pp. 15-18

TEXT: Cast iron in a ladle-converter of 0.7-t holding capacity is blown through with oxygen. The tuyere is located in the lower part of the converter. A flexible hose is connected to it from the reducer of the delivery ramp, to which O_2 cylinders are connected. Cast iron having a temperature of 1,300-1,400°C is poured into the converter, heated up to 600-700°C and tilted at an angle of 30°. O_2 is supplied somewhat earlier than the converter is turned into the vertical position. The blowing conditions are determined by the necessary quantity of C (generally in the course of 6-10 minutes at a pressure of 5 at.).

Translator's note: This is the full translation of the original Russian abstract.

Card 1/1

YELIZAROV, D. P. Cand. Tech. Sci.

Dissertation: "Investigation of the Processes of Regulating Deaerators." Moscow Order of Lenin Power Engineering Inst imeni V. M. Molotov, 11 Apr 47.

SO: Vechernyaya Moskva, Apr, 1947 (Project #17836)

YELIZAROV, D.P., kandidat tekhnicheskikh nauk; PERMYAKOV, V.A., kandidat tekhnicheskikh nauk.

Investigation of bubbling in deaerators. Trudy MEI no.25:143-155 '55. (Feed-water purification) (MIRA 9:7)

YELIZAROV, D.P.

BELINSKIY, A.Ya., kand. tekhn. nauk; YELIZAROV, D.P., kand. tekhn. nauk.

Feed-water pumps for electrical power plants of super-high and super-critical parameters. Teploenergetika 4 no.12:78-81 D '57. (MLRA 10:11)
(Electric power plants) (Pumping machinery)

YELIZAROV, D.P., kand.tekhn.nauk

Stresses in the flange connection of a high parameter steampipe during the warming up period. Teploenergetika no.4:33-38 Ap '60. (MIRA 13:8)

1. Moskovskiy energeticheskiy institut.
(Pipe flanges)

S/096/60/000/012/002/008
E194/E484

AUTHOR: Yelizarov, D.P., Candidate of Technical Sciences

TITLE: Stresses in the Walls of a High-Pressure Steam Pipe During Heating

PERIODICAL: Teploenergetika, 1960, No.12, pp.19-23

TEXT: The tests described in this article were made on the main steam piping of a once-through boiler type 67-СП (67-SP), a schematic diagram of which is shown in Fig.1. The steam pipe was 273 x 28 mm diameter, was made of pearlitic steel grade 12МХ (12MKh) and operates with steam conditions of 100 atm and 510°C. The piping assembly has two fixed supports on the section investigated and the other eight supports have various kinds of flexibility. There are three branch pipes. Before the tests, calculations were made of the self-compensation of the test section of pipework by the elastic centre method. Calculations were made of the referred stress due to self-compensation and internal pressure at piping sections near each of the fixed supports assuming that with the piping cold the compensation stresses are zero, see tables. No allowance was made for erection tension,

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E194/E484

Stresses in the Walls of a High-Pressure Steam Pipe During Heating

the influence of branch pipes or the weight of the piping itself. Besides the stresses due to self-compensation and internal pressure there are additional stresses due to temperature differences in the pipe walls. The causes of the main types of such temperature difference are discussed. Amonst others, there is a radial temperature difference in the piping which may be sub-divided into static and dynamic components, the dynamic component arising only during transient temperature conditions. The radial temperature difference in the steam pipe wall causes additional tensile, axial and tangential stresses at the external surfaces and a formula is given for their calculation. The experimental equipment is described, particularly the mechanical tensiometers, made of the same metal as the pipework to avoid differential expansion, with one end fixed to the pipework and the other resting on a roller carrying a pointer, see Fig.2. The instrument for measuring tangential strain illustrated in Fig.3 operates on a similar principle. The placing of the various tensiometers on the piping is described. Before the main tests were started, the tensiometer
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Stresses in the Walls of a High-Pressure Steam Pipe During Heating

readings were checked by comparing them with calculated stresses due to internal pressure or during hydraulic tests of the cold piping. The main difficulty in using the tensiometers was in making temperature corrections. The temperatures were measured manually with a portable potentiometer by a single observer and this took a great deal of time and, therefore, in working out the results all the temperatures had to be referred back to a reference time. This affected the tensiometer error. Nevertheless, the results may be considered acceptable, see graphs of Fig.5, which shows stresses in the wall of steam piping at the external surface during heating and cooling. The pipework was heated up three times and cooled down twice and the agreement between the results is good. However, as the method of temperature measurement was not entirely satisfactory it was not possible carefully to follow the stresses during transient temperature conditions. The total axial stress on the upper surface of the tubing at the position of measurement was nearly zero apparently because the measurements were made near a bend and the upper surface of the tube was then
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Stresses in the Walls of a High-Pressure Steam Pipe During Heating

put under compression during heating whilst the internal pressure applied tension, the two practically compensating one another. This is confirmed by measurements of vertical displacement of two points on the steam piping by means of special reference points fixed at the spring supports, see graphs of Fig.6. The experimental values of the stresses plotted in Fig.5 are somewhat higher than the calculated values. The tangential stress due to internal pressure and the radial temperature difference, even on uninsulated steam piping are $2.88 + 2.5 = 6.38$ kg/mm^2 by calculation as against 7 to 8 kg/mm^2 by test. The axial stress on the most highly stretched part allowing for radial temperature difference is $4 + 2.5 = 6.5$ kg/mm^2 by calculation and 6 to 7 kg/mm^2 by test. The difference is apparently due to additional stresses not allowed for in the calculation, for example, those due to temperature difference around the circumference of the piping. It is of interest to compare the stress values obtained with the strength characteristics of steel grade 12MKh under these conditions.

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Stresses in the Walls of a High-Pressure Steam Pipe During Heating

The calculated value of the yield limit of steel 12MKh at a temperature of 510°C at 16.6 kg/mm^2 and the long-term ultimate strength at 510°C for 100000 hours is 12 kg/mm^2. Thus, the present work confirms the possibility of increasing the rate of heating of steam piping made of steel grade 12MKh up to 8°C per minute, because the stresses will then remain within the permissible limits. There are 6 figures, 1 table and 2 Soviet references.

ASSOCIATION: Moskovskiy energeticheskiy institut
(Moscow Power Engineering Institute)

YELIZAROV, D.P., kand.tekhn.nauk

Calculation of the permissible heating rate of steam pipes. Teploenergetika 8 no.3:80-85 Mr '61. (MIRA 14:9)
(Steam pipes)

YELIZAROV, D.P., kand.tekhn.nauk

Temperature stresses in steampipes made with 12KhMF steel in case of heating. Teploenergetika 9 no.10:59-64 0 '62.
(MIRA 15:9)

1. Moskovskiy energeticheskiy institut.
(Steampipes) (Thermal stresses)

S/096/63/000/002/009/013
E193/E383

AUTHORS: Polyakov, A.L., Engineer, Yelizarov, D.P., Candidate of Technical Sciences and Volkov, S.V., Engineer

TITLE: Stresses in austenitic-steel steam-supply line during the warming-up stage

PERIODICAL: Teploenergetika, no. 2, 1963, 69 - 73

TEXT: Operational experience in steam power plants, working under conditions of high steam pressure and temperature, shows that welds in austenitic steam pipes are not reliable as they are liable to crack in service. According to some authorities, these failures are caused by internal stresses due to thermal expansion and the object of the present investigation was to check the validity of this view by determining the stresses set up in the steam-supply line in the warming-up stage. The measurements were conducted at a power station on steam-supply pipes (29 mm in diameter, 27 mm wall thickness) originally made of steel ЭИ-257 (EI-257), some portions of which had been replaced during general overhaul by steel 1Х18Н12Т (1Kh18N12T) and 1Х18Н9Т (1Kh18N9T) pipes. The measurements were duplicated by using both mechanical and strain measurements

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wire resistance strain gauges, the former being applied in the entire steam-temperature range studied (20 - 520 °C), the use of the latter being restricted to temperatures below 400 °C. Only the axial strains ε_a were measured, the corresponding axial stresses being given by:

$$\sigma_a = \frac{E}{1 - \mu^2} (\varepsilon_a + \mu \varepsilon_t) \tag{1}$$

where E is the elastic modulus, μ the Poisson ratio and ε_t the tangential strain. Approximate values of ε_t were obtained from Eq. (3), the magnitude of the tangential stress σ_t being preliminarily determined from:

$$\sigma_t = \frac{p}{100} \frac{2}{\beta^2 - 1} \tag{4}$$

where p is the steam frequency (kg/cm^2) and β is the o.d./i.d. ratio, equal in the present case to 1.33. Measurements were

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conducting during the warming-up stage lasting about 140 h. In addition to axial strength in the critical parts of the steam-supply line, the temperature and rate of heating of the pipe walls, steam pressure, load on the generator and several other parameters were recorded. The summarized results are reproduced in Fig. 3, where the axial stress σ (kg/mm^2) in the pipe is plotted against the test temperature (θ °C), curves 1 and 2 relating, respectively, to results given by the wire resistance and mechanical strain gauge. The recorded value of σ_a at 520 °C was 5 kg/mm^2; taking the calculated value of σ_t as 4.5 kg/mm^2, the shear stress $\tau = 0$ and the radial stress on the wall surface $\sigma_r = 0$, a value of 4.77 kg/mm^2 was obtained for the reduced stress in the tube. Since the permissible stress in austenitic steel tubes at 570 °C is 7.7 kg/mm^2, the results of the present investigation show that cracking of the welded joints cannot be attributed to excessively high, thermally-induced stresses. Failures of the welded joints are probably caused by a combination of factors, including the weakening effect of the welding operation on the heat-affected zone and the presence in this zone of additional,

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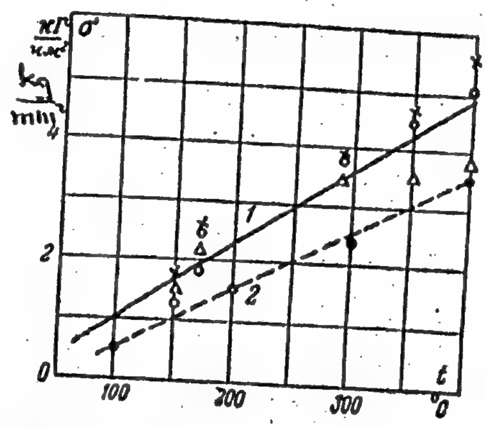
internal stresses, not taken into account in the calculations and not revealed by the strain measurements as applied in the present investigation. There are 3 figures.

ASSOCIATION: TsNIITMASh - MEI

Fig. 3:



POLYAKOV, A.L., inzh.; YELIZAROV, D.P., kand.tekhn.nauk; VOLKOV, S.V., inzh.

Stresses arising in the heating of a stemapipe from austenitic steel. Teploenergetika 10 no.2:69-73 F '63. (MIRA 16:2)

1. TSentral'nyy nauchno-issledovatel'skiy institut tekhnologii i mashinostroyeniya i Moskovskiy energeticheskiy institut.
(Steampipes) (Pipe, Steel)

YELIZAROV, D.P., kand.tekhn.nauk; YASIN, S., inzh.

Tensiometer for determining metal stresses at high temperatures. Izv. vys. ucheb. zav.; energ. 5 no.10:124-130 O '62. (MIRA 15:11)

1. Moskovskiy ordena Lenina energeticheskiy institut.
(Tensiometers)

YELIZAROV, D.P., kand.tekhn.nauk; FEDOROVICH, L.A., inzh.; YASIN, S., inzh.

Stresses in the drum of a TP-80 boiler during its firing. Teploenergetika 11 no. 1:28-32 Ja '64. (MIRA 17:5)

1. Moskovskiy energeticheskiy institut.

YELIZAROV, D.P., kand. tekhn. nauk; FEDOROVICH, L.A., inzh.; YASIN, S., inzh.

Stresses in the austenitic collectors of a steam superheater during the firing of a boiler. Teploenergetika 11 no.6:37-40 Je '64. (MIRA 18:7)

1. Moskovskiy energeticheskiy institut.

ACCESSION NR: AP4042622 S/0096/64/000/008/0090/0092

AUTHOR: Yelizarov, D. P. (Candidate of technical sciences)

TITLE: Operational observations of creep in steam pipes, with the aid of the new system of MEI

SOURCE: Teploenergetika, no. 8, 1964, 90-92

TOPIC TAGS: creep, steam power plant, welding technology/ MEI creep measuring apparatus, 12KhMF steel, TP 80 boiler

ABSTRACT: Creeping of steam pipes under operating conditions above 450C was observed by measuring the increase in the pipe diameters in two perpendicular directions. Newly constructed apparatus of the Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute) made it possible to take continuous measurements with a timing indicator without removing the pipe insulation. The longitudinal distances between points at which measurements were taken were made shorter than in the older methods in order to diminish the errors (see Fig. 1 on the Enclosure). Since the results obtained in these experiments were accurate, the apparatus is simple, and the procedure is easy, it is advisable to make wider use of this method in the control sections of steam pipes in electric power stations. Orig. art. has: 2 formulas and 3 figures.

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ACCESSION NR: AP4042622

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute)

SUBMITTED: 00 ENCL: 01

SUB CODE: ME NO REF SOV: 001 OTHER: 001

Card 2/3

ACCESSION NR: AP4042622

ENCLOSURE: 01

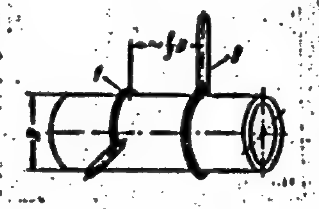

Fig. 1. A method for fixing the MEI equipment on a steam pipe.

1- horizontal apparatus; 2- vertical apparatus.

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L 10551-66 EWT(m)/EWP(w)/EWA(d)/EWP(t)/EWP(k)/EWP(z)/EWP(b)/EWA(c) JD/HW/EM

ACC NR: AP6000784 UR/0096/65/000/009/0034/0038

AUTHOR: Gorelkin, B.G. (Engineer); Krasil'nikov, S.N. (Engineer); Fedorovich, L.A. (Engineer); Yelizarov, D.P. (Candidate of Tech.Sci.); Fedosov, A.I. (Candidate of Tech.Sci).

ORG: TsNIITMASh; MEI

TITLE: The problem of the stresses acting in a steam pipe made of austenitic steel

SOURCE: Teploenergetika, no.9, 1965, 34-38

TOPIC TAGS: stress analysis, pearlite steel, austenite steel, steam power plant, pipe/1Kh18N12T steel

ABSTRACT: The high temperature coefficient of linear expansion and the low coefficien. of thermal diffusivity of austenitic steel bring about, in the wall of the steam pipe, higher temperature and compensation stresses than in steam pipes made of pearlitic steel. In the experiments, the initial pressure of the steam before the turbine was 170 bars and the temperature was from 550 to 570°C. Each block of the unit, with a power up to 150 Mwt, consisted of a turbine and two boilers connected with the turbine by four lines of main steam piping (two from each boiler). The steam piping tested was made of 1Kh18N12T steel and had a diameter and a wall thickness of 219 x 27 mm. Measurements of the stresses at high steam

Card 1/2 UDC: 624.058.5:621.772.4.001.45

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ACC NR: AP6000784

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temperatures was effected with type MEI mechanical tensometers. The tangential stresses were evaluated by calculation and, knowing the tangential stress, it is possible to calculate the tangential deformation. Finally, the axial stress can then be calculated. A series of tests was run to determine the dependence of the tangential stresses on the rate of heating of the pipe up to a temperature of 550°C. Results are shown graphically. If the "rate" stresses are added to the static stresses measured with the tensometers, the authors arrive at a value on the order of 15 kg/mm^2 which is close to the standard yield point for 1Kh18N12T steel. In conclusion, the proposition is advanced that one possible reason for the failure of welded joints in austenitic steel steam pipes is the increased magnitude in the sum of the stresses brought about by the superposing of significant "rate" stresses, connected with variations in the steam temperature, on top of the static stresses. Orig. art. has: 4 formulas and 5 figures.

SUB CODE: 11,13 SUBM DATE: 00 ORIG REF: 003 OTH REF: 000

Card 2/2 pw

YELIZAROV, D.P., kand. tekhn. nauk; FEDOROVICH, L.A., inzh.; YASIN, S., inzh.

Stresses during the heating of thick-walled flanges of main steampipes. Elek. sta 36 no.4:36-42 Ap '65. (MIRA 18:6)

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SOV/106-59-10-2/11

6.9000

AUTHORS: Yelizarov, F. V., and Yurkov, Yu. A

TITLE: The Spectra of Phase-Keyed Signals 4

PERIODICAL: Elektrosvyaz', 1959, Nr 10, pp 13-22 (USSR)

ABSTRACT: To solve problems arising in telemetric and other systems, in which the phase of a carrier oscillation is "keyed", it is of practical importance to know the spectrum characteristics of pulsed and continuous oscillations, which are phase-keyed in various ways. The problem is formulated as follows: it is required to find the spectrum of a single-pulse, of a series of pulses, or of a periodic train of pulses, the duration of each being τ, and the oscillation within the envelope - the contained oscillation - being harmonic. Also, during the time τ the phase of the contained oscillation changes by a step q times and remains unchanged for a time τ_k between steps. In the general case, the value of the phase after each step can be written in the form $\Theta_k = i\Theta$, where i can take any value, positive or negative, the total number being q. In the case of a periodically phase-keyed signal, the values of i in each pulse repeat in the same sequence. If in the

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periodic train, the repetition frequency of the pulses F is made equal to $1/\tau$, then this pulse train becomes a continuous, phase-keyed signal. Depending on whether the signal is a periodic or an aperiodic function, then the Fourier series or the Fourier integral respectively is used. The formulae produced are applicable to any shape envelope and any non-random keying law, but for clarity the Authors choose as examples signals with rectangular envelopes and step changes in phase, in which i takes the values 1, 2, 3,...., q. The Authors first consider phase-keyed, aperiodic functions, consisting of either a single pulse or a series of pulses. The general expression for any component can be written

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$$f_k(t) = F_k(t) \sin(\omega_0 t + \varphi_k)$$

where $\sum_{\alpha=1}^{k} \tau_\alpha - \tau_k < t < \sum_{\alpha=1}^{k} \tau_k$

Card 2/4 $f_k(t) = 0$ outside the given interval, and $k = 1, 2, .., q$

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is the number of the pulse component; $F_k(t)$ is the function describing the envelope, and O_k is the initial phase of the contained oscillation. The spectrum for a single pulse is given in Eq (3), and for a series of p pulses in Eq (5) and (6); Eq (5) is applicable when p is odd, and Eq (6) when p is even. Next is investigated the spectrum for a periodic train of pulses of the type

$$\left.\begin{aligned} f_1(t) &= F_1(t)\sin(\omega_0 t + \Theta_1) \text{ when } 0 < t < \tau; \\ &\quad T < t < T + \tau \\ &\quad 2T < t < 2T + \tau \text{ and so on} \\ f_1(t) &= 0 \text{ outside the given interval} \end{aligned}\right\}$$

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where T is the period of the pulse sequence, $T = nT_0$, $n > 1$ and is a whole number. The spectrum is written in several forms (Eq 10 to 13). The general formulae obtained are applied to sixteen particular

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examples and the results tabulated in Table 1. There is 1 figure, 1 table and 4 Soviet references.

SUBMITTED: May 21, 1959

Card 4/4

YELIZAROV, G.I.

Effect of physical culture on the development of children of the nursery age. Pediatriia no.2:84-85 Mr-Ap '54. (MLRA 7:6)

1. Iz detskikh yasley imeni I.V.Stalina (g. Kurgan, obl.)
(INFANTS,
*eff. of phys. exercise on develop.)
(PHYSICAL EDUCATION AND TRAINING,
*eff. on inf. develop.)
(BODY HEIGHT,
*eff. of phys. exercise on inf. develop.)
(BODY WEIGHT,
*eff. of phys. exercise on inf. develop.)

YELIZAROV, G.P.

Clinical aspects, prophylaxis and therapy of dermatitis caused by caprolactam. Gig.truda i prof.zab. 3 no.3:20-25 My-Je '59.
(MIRA 12:10)

(HEXAMETHYLENIMINE--TOXICOLOGY) (SKIN--DISEASES)

YELIZAROV, G.P.

Occupational diseases of the skin in workers of the radio-receiver sets industry. Gig. truda i prof. zab. 7 no.1:49-50 Ja'63. (MIRA 16:12)

YELIZAROV, G.P.; SEREBRYAKOV, V.I. (Gor'kiy)

Occupational skin diseases caused by DDT and hexachloran.
Gig. truda i prof. zab. 7 no.3:54-56 Mr'63 (MIRA 17:1)

1. Instytut gigiyeny truda i professional'nykh bolezney, Gor'kiy.

YELIZAROV, I. (g. Kazan')

Method of detecting shorted turns. Radio no.5:33 My'55.
(Electric coils) (MIRA 8:6)

YELIZAROV, K. N.

YELIZAROV, K.N.

[Basic theory of atomic structure; for the physics course in secondary schools] Osnovy ucheniia o stroenii atoma v kurse fiziki srednei shkoly Leningrada. Moskva, Gos. uchebno-pedagog. izd-vo, 1953. 166 p. (MLRA 7:7)
(Atomic theory)

YELIZAROV, K.N.

[Electromagnetic oscillations and waves in the physics course for secondary schools] Elektromagnitnye kolebaniia i volny v kurse fiziki srednei shkoly. Izd. 2-e. Leningrad, Uchpedgiz, 1954. 183 p.(MLRA 7:12D)

TIMOFEYEVA, Nonna Nikolayevna; YELIZAROV, K.N., redaktor

[Peaceful use of atomic energy; a bibliography for students in classes 7-10] Mirnoe primenenie atomnoi energii; rekomendatel'nyi spisok literatury dlia uchashchikhsia 7-10 klassov. Leningrad, 1956. 24 p. (MLRA 9:7)

1. Leningrad. Publichnaya biblioteka.
   (Bibliography--Atomic power)

YELIZAROV, Konstantin Nikolayevich; BARKOVSKIY, I.V., redaktor; MAKHUSHIN, V.A., tekhnicheskiy redaktor.

[Organizing the physics lesson; a manual for teachers] Organizatsiia uroka fiziki; posobie dlia uchitelei. Izd.2-oe, ispr. i dop. Leningrad, Gos.uchebno-pedagogicheskoe izd-vo Ministerstva prosveshcheniia RSFSR, Leningradskoe otd-nie, 1956. 207 p. (MLRA 9:5)
(Physics--Study and teaching)

TIMOFEYEVA, Inesa Nikolayevna; YELIZAROV, K.N., redaktor

[Machines in industry, agriculture, and transportation; a bibliography for students in grades 7-10] Mashiny v promyshlennosti, sel'skom khoziaistve, na transporte; rekomendat'nyi spisok literatury dlia uchashchikhsia 7-10 klassov. Leningrad, 1957. 34 p. (MIRA 10:3)

1. Leningrad, Publichnaya biblioteka. (Bibliography--Machinery)

Yelizarov, K.N.

RUMYANTSEV, Ivan Vasil'yevich; YELIZAROV, K.N., red.; RAKOVITSKIY, I.G., tekhn.red.

[Demonstrations in the study of kinematics and the laws of dynamics in secondary schools; a manual for teachers of physics] Demonstratsii pri izuchenii kinematiki i zakonov kinamiki v srednei shkole; posobie dlia uchitelei fiziki. Leningrad, Gos.uchebno-pedagog. izd-vo M-va prosv. RSFSR, Leningr.otd-nie, 1957. 95 p. (MIRA 11:3)
(Kinematics--Experiments) (Dynamics--Experiments)

YELIZAROV, Konstantin Nikolayevich; BARKOVSKIY, I.V., red.; LEONT'YEVA, L.A., tekhn.red.

[Alternating current in the physics course for secondary schools; a manual for teachers] Peremennyi tok v kurse fiziki srednei shkoly; posobie dlia uchitelei. Leningrad, Gos. uchebno-pedagog. izd-vo M-va prosv. RSFSR, Leningradskoe ot-nie, 1957. 276 p. (MIRA 11:4)

(Electric currents, Alternating)

YELIZAROV, Konstantin Nikolayevich; BASOV, G.V., red.; KORNEYEVA, V.I., tekhn.red.

[Fundamentals of the teaching of the electric field (electrostatics) in secondary schools; teachers manual] Osnovy ucheniia ob elektricheskom pole v srednei shkole (elektrostatika); posobie dlia uchitelei. Moskva, Gos.uchebno-pedagog.izd-vo M-va prosv.RSFSR, 1959. 173 p. (MIRA 13:4)

(Electric fields)

ACCESSION NR: AP4033129 S/0120/64/000/002/0126/0127

AUTHOR: Makov, B. N.; Yelizarov, L. I.; Dmitriyev, Ye. A.

TITLE: Methods of measuring dissociation cross-sections of H_2^+ fast ions passing through gas targets

SOURCE: Pribory* i tekhnika eksperimenta, no. 2, 1964, 126-127

TOPIC TAGS: cross section, dissociation cross section, hydrogen ion dissociation, hydrogen ion dissociation cross section, collision chamber, gas target

ABSTRACT: To obviate the difficulties in selecting slits in the dissociation cross-section measurements, a new arrangement (see Enclosure 1) is suggested in which the currents are measured directly in the collision chamber. The hydrogen-ion beam is admitted into the analyzer chamber ACh through slit S_1. The collision chamber CCh is separated by a partition which helps in trapping

ACCESSION NR: AP4033129

extraneous ions. Both chambers are traversed by a magnetic field produced by an electromagnet. The beam focused with a 90° deviation passes slit S_2. The initial ion-beam current is measured immediately beyond S_2 by a retractable receiver Π. The proton current i_{H+} is measured by a receiver P. A 100-kev hydrogen-ion beam was passed through 4x8- and 3x10-mm slits, respectively. The current measured was 25 microamp; pressure in the collision chamber, $(3.5-15) \times 10^{-5}$ torr; total cross-section, 6.3×10^{-16} cm^2 per molecule, and f = 1.1. Orig. art. has: 1 figure.

ASSOCIATION: none

SUBMITTED: 17Sep62 DATE ACQ: 11May64 ENCL: 01

SUB CODE: NS NO REF SOV: 001 OTHER: 001

Card 2/2

[illegible] inzh.; YEN[illegible]AROV, M.A., [illegible]

[illegible] for use in the construction of electric power trans- [illegible] lines. Energ. stroi. [illegible]

(MIRA 18:3)

YELIZAROV, N.

Our practice and several deductions. Sots. trud 8 no.6:40-44 Je '63.
(MIRA 16:9)

1. Nachal'nik otdela organizatsii i oplaty truda Stavropol'skogo krayevogo upravleniya proizvodstva i zagotovok sel'skokhozyaystvennykh produktov.

(Stavropol territory —Agricultural wages)

YELIZAROV, ~~N.~~

It is possible to work with gasmen. Sov.shakht. 10 no.3:34 Mr '61. (MIRA 14:7)

1. Zamestitel' nachal'nika uchastka ventilyatsii shakhty "Koksovaya-1" Kemerovskogo sovnarkhoza.
(Mine ventilation)

YELIZAROV, Nikolay Fedorovich; KRASHENINNIKOV, G.D., redaktor; KOMAR'KOVA, L.M., redaktor izdatel'stva, KUZ'MIN, G.M., tekhnicheskiy redaktor

[Stereoplanograph manual] Posobie po rabote na stereoplanigrafe. Moskva, Izd-vo geodez. lit-ry, 1956. 175 p. (MLRA 9:8)
(Photogrammetry)

YELIZAROV, Nikolay Fedorovich; GERTSENOVA, K.N., red.; KOMAR'KOVA, L.M., red. izd-va; ROMANOVA, V.V., tekhn. red.

[Textbook for operating a multiplex] Posobie po rabote na mul'tiplekse. Moskva, Geodezizdat, 1962. 170 p. (MIRA 15:7)
(Photogrammetry)

PERVOZVANSKIY, V.V.; YELIZAROV, N.F.

Stereotopographic surveying in wooded regions. Geod. i kart. no.1: 31-39 Ja '62. (MIRA 15:1)
(Aerial photogrammetry)

VASIL'YEV, V.M.; AVILOV, A.A.; ALMAZOV, A.D.; BALASHOV, A.V.; VOLKOV, A.M.; YELIZAROV, N.G.; LAPUTIN, A.Ya.; RYABOV, V.M.; SABUNAYEV, V.B.; SAMARIN, D.A.; SUETIN, V.A.; KHERSONSKIY, Kh.N.; TSETEL'MAN, F.V.; GORBACHEVA, N.A., red.; TRIPOL'SKIY, L.G., red.; MANINA, M.P., tekhn.red.

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(Zavodskaya Laboratoriya, ... applicability of a ...
Russian). Attachments for extending the ... and transverse